DETAILED ACTION

This Office Action is in response to the Amendment filed on 03/04/2010.

Applicant's cooperation in correcting the informalities in the drawing and specification is appreciated. Applicant's cooperation in amending the claims to overcome the claim rejections relating to indefinite claim language is also appreciated.

Claims 1 and 31 were amended; and

Claims 5-14 and 17-25 were cancelled.

Drawings

The Amendment to drawings received on 03/04/2010 is accepted.

Specification

The Amendment to Specification submitted on 03/04/2010 is accepted.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view of Pischinger (Pub. Number WO 01/36797 A1).

Takeshi Yamane discloses a turbocharged internal combustion engine (1) including:

a variable volume combustion chamber (2);

inlet valve means (20, 21) controlling flow of air into the combustion chamber (2);

exhaust valve means (22, 23) for controlling flow of combusted gases from the combustion chamber (2);

a fuel delivery means (Not Shown, Well-known components of the internal combustion engines) for delivering fuel into the air to be mixed therewith for combustion;

exhaust valve means (22, 23) for controlling flow of combusted gases from the combustion chamber (2);

compressor means (5B, 6B) for compressing the air prior to admission of the air into the combustion chamber (2);

wherein the improvement in turbocharged internal combustion engine (1) comprises:

actuator means (Not Shown, Well-known components of the internal combustion engines) for opening and closing the exhaust valve means (22, 23),

a controller (Not Shown, Well-known components of the internal combustion engines) configured to control operation of the actuator means to thereby control opening and closing of the exhaust valve means (22, 23),

the exhaust valve means (22, 23) including at least a first exhaust valve (22) connected to a first exhaust duct (24) and at least a second exhaust valve (23) connected to a second exhaust duct (25) separate and independent from the first exhaust duct (24); said electronic controller being operative to control timing of operation of said actuator means to control timing of opening and closing of said first exhaust valve and to control timing of opening and closing of said second exhaust valve;

the compressor means (5B, 6B) including a first turbocharger (5A) and the first exhaust duct (24) being connected to the first turbocharger (5A) so that exhaust gases passing through the first exhaust duct (24) drive the first turbocharger (5A) to rotate;

the second exhaust duct (25) bypassing the first turbocharger (5, 5A) and the combusted gases flowing through the second exhaust duct (25) being exhausted without passing through the first turbocharger (5, 5A); and

the first and second exhaust valves (22, 23) being operable to control flow of the combusted gases leaving the combustion chamber (2) flow through each of the first and second exhaust ducts (24, 25);

the compressor means (5B, 6B) additionally including a second turbocharger (6, 6A, 6B) receiving charge air for compression by the second turbocharger (6, 6A, 6B);

wherein the first turbocharger (5, 5B, 5A) is a high pressure turbocharger and the first turbocharger (5, 5B, 5A) being configured to

receive compressed air at a first pressure from the second turbocharger (6, 6B, 6A), the second turbocharger (6, 6B, 6A) being a low-pressure turbocharger, and the first turbocharger (5B) being configures to compress the compressed air from the second turbocharger to a second higher pressure;

combusted gases leaving the first turbocharger (5, 5B, 5A) after expansion in a turbine (5A) thereof being combined with the combusted gases flowing in the second exhaust duct (25) and then the combined flow of combusted gases driving the second turbocharger (6, 6B, 6A) to rotate;

all exhaust gases passing through the first exhaust gas duct flowing through the first turbocharger (5, 5B, 5A) prior to flowing the second turbocharger (6, 6B, 6A) (See Page 6, lines 1-8 and 12-19 of the fully certified English translation copy);

(Re. 3) a first intercooler (10) through which air compressed in the second low pressure turbocharger (6, 6B, 6A) passes before reaching the first high pressure turbocharger (5, 5B, 5A) (See Figure 1-2 and 4, and Abstract of the fully certified English translation copy); and

(Re. 15) the engine having a first combustion mode and a second combustion mode, fuel being mixed with air in the first combustion mode to produce homogenous mixture which is then ignited by homogeneous charge compression ignition and fuel being ignited by compression ignition in the combustion chamber in said second combustion mode.

Takeshi Yamane discloses the invention as recited above; however, Takeshi Yamane fails to disclose the electronic controller being operative to control timing of the actuator means and the timing of opening and closing of the first exhaust valve and the second exhaust valve controlling the proportion of the flow of exhaust gas which flows through the first exhaust duct to the first turbocharger relative to the second exhaust duct being varied by variation of opening and closing of the first exhaust valve.

Pischinger teaches that it is conventional in the supercharged internal combustion engine art, to utilize the electronic controller (6) (See Figure) being operative to control timing of the actuator means (5.1, 5.2) to control timing of opening and closing of the first and second exhaust valves (3.1, 3.2); and the timing opening and closing of the first exhaust valve (3.1) and the timing of opening and closing of the second exhaust valve (3.2) controlling the proportion of the flow of exhaust gas which flows through the first exhaust duct (7.1) to the first turbocharger (8, 9) relative to the second exhaust duct (7.2) being varied by variation of the timing opening and closing of the first exhaust valve (3.1) (See Figure, Page 6, lines 11-23, Page 7, lines 1-21 of the fully certified English translation copy).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized the electronic controller; and the timing of opening and closing of the first exhaust valve and the second exhaust valve controlling the proportion of the flow of exhaust gas which flows through the first exhaust duct to the first turbocharger relative to the second exhaust duct being varied by variation of the timing of opening and closing of the first exhaust valve, as taught by Pischinger, to

optimize the exhaust gas to rise to the maximum supercharging pressure of the turbocharger with almost no time lag and to reduce exhaust emissions for the Takeshi Yamane device.

Note that:

1. The recitation of "fuel being mixed with air in the first combustion mode to produce homogenous mixture which is then ignited by homogeneous charge compression ignition and fuel being ignited by compression ignition in the combustion chamber in said second combustion mode" is considered as the functional language. Takashi Yamane discloses all the structural components of an engine system, which are read on those of the instant invention. Therefore, the Takashi Yamane system is capable of performing the same desired functions as the instant invention having been claimed in claim 15.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view Pischinger (Pub. Number WO 01/36797 A1), and further in view of Yasuyuki Santo (Patent Number JP 01-285619 A).

The modified Takeshi Yamane device discloses the invention as recited above, and further discloses a catalytic converter (11) (See Figure of Pischinger).

However, the modified Takeshi Yamane device fails to disclose the location of the catalytic converter.

Yasuyuki Santo teaches that it is conventional in the supercharged internal combustion engine art, to utilize the catalytic converter (15) receiving combusted gases leaving the second turbocharger then to atmosphere (See Figure 1).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have positioned the catalytic converter at downstream of the second turbocharger, as taught by Yasuyuki Santo, to purify the exhaust gas.

Claims 4, 26 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view of in view Pischinger (Pub. Number WO 01/36797 A1) and Yasuyuki Santo (Patent Number JP 01-285619 A), and further in view of Yuji Hirabayashi (Patent Number JP 61-277818 A).

The modified Takeshi Yamane device discloses the invention as recited above, and further discloses the compressor means comprising additionally an intercooler (10) for cooling the compressor intake air prior to delivery of the air into the combustion chamber (2) (See Figures 1-2 and 4);

> wherein the fuel delivery means (Not Shown, Well-known components of the internal combustion engines) is operative to deliver fuel into the combustion chamber (2) early enough in an upstroke for mixing of the fuel with air to produce a homogeneous mixture which is then ignited by homogenous charge compression ignition and wherein the fuel delivery means (Not Shown, Well-

known components of the internal combustion engines) is operative to deliver fuel later in the upstroke for compression ignition in the combustion chamber.

However, the modified Takeshi Yamane device fails to disclose an intake air bypass passage having a bypass valve.

Hirabayashi teaches that it is conventional in the art of multistage type turbo-supercharged internal combustion engines, to utilize a bypass passage (from 5 to 18) having a bypass valve (7) controlling flow of air through the bypass passage and air compressed by the second turbocharger (2, 9) flows through the intake air bypass passage to the intake air passage to the inlet valve means by bypassing the first high pressure turbocharger (See Figures 1-2, Abstract).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized a bypass passage having a bypass valve, as taught by Hirabayashi, to improve the efficiency of the modified Takeshi Yamane device, since the use thereof would have control the compressed intake air to be delivered into the engine based on the operating condition of the engine.

Note that the recitation of "wherein the fuel delivery means being operative to deliver fuel into the combustion chamber early enough in an upstroke for mixing of the fuel with air to produce a homogeneous mixture which is then ignited by homogenous charge compression ignition and wherein the fuel delivery means being operative to deliver fuel later in the upstroke for compression ignition in the combustion chamber" is considered as the functional

language. Takashi Yamane discloses all the structural components of an engine system, which are read on those of the instant invention. Therefore, the modified Takashi Yamane system is capable of performing the same desired functions as the instant invention having been claimed in claim 29.

Additionally, when a claim includes a 'whereby" clause or similar clause, it must contain, in order to be complete, an enumeration of sufficient elements to perform the function so specified in such clause. A "whereby' clause is not objectionable. It merely states the result and adds nothing to the patentability of a claim (Israel v. Cresswell, 76 USPQ 594; In re Boileau, 1948 C. D. 83).

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view of in view Pischinger (Pub. Number WO 01/36797 A1) and Yasuyuki Santo (Patent Number JP 01-285619 A), and further in view of either Lovell (Patent Number 3,202,141) or Gray (Patent Number 6,550,430 B2).

The modified Takeshi Yamane device discloses the invention as recited above; however, the modified Takeshi Yamane device fails to disclose the exhaust valve means being closed to trap combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition.

Lovell/Gray teaches that it is conventional in the art of operating compression ignition engine, to utilize in part loading operating conditions of the engine, the exhaust valve means being closed during the upstroke of the piston in order to trap combusted gases in the combustion chamber, the trapped combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition (Column 3, lines 27-54, Column 7, lines 74-75, and Column 8, lines 1-8 of Lovell; Column 2, lines 25-45, Column 3, lines 62-67, Column 4, lines 1-21, Column 6, lines 59-67, Column 7, lines 1-4 and 27-42, Column 13, lines 25-67, Column 14, lines 36-53, Column 15, lines 4-10 and 32-51 of Gray).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized the exhaust valve means being closed to trap combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition, to improve the efficiency of the modified Takeshi Yamane device, since the use thereof would have controlled the desired air-fuel ratio for operating the engines.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view of in view Pischinger (Pub. Number WO 01/36797 A1), Yasuyuki Santo (Patent Number JP 01-285619 A)

and Yuji Hirabayashi (Patent Number JP 61-277818 A), and further in view of either Lovell (Patent Number 3,202,141) or Gray (Patent Number 6,550,430 B2).

The modified Takeshi Yamane device discloses the invention as recited above; however, fails to disclose the exhaust valve means being closed to trap combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition.

Lovell/Gray teaches that it is conventional in the art of operating compression ignition engine, to utilize in part loading operating conditions of the engine, the exhaust valve means being closed during the upstroke of the piston in order to trap combusted gases in the combustion chamber, the trapped combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition (Column 3, lines 27-54, Column 7, lines 74-75, and Column 8, lines 1-8 of Lovell; Column 2, lines 25-45, Column 3, lines 62-67, Column 4, lines 1-21, Column 6, lines 59-67, Column 7, lines 1-4 and 27-42, Column 13, lines 25-67, Column 14, lines 36-53, Column 15, lines 4-10 and 32-51 of Gray).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized the exhaust valve means being closed to trap combusted gases forming a mixture with the fuel and air and serving to delay ignition of the fuel and air mixture when the engine is operating in the first combustion mode with homogenous charge compression ignition, to improve the efficiency of the modified

Takeshi Yamane device, since the use thereof would have controlled the desired air-fuel ratio for operating the engines.

Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takeshi Yamane (Patent Number JP 61-164039 A), in view of in view Pischinger (Pub. Number WO 01/36797 A1), and further in view of Baker (Patent Number 5,199,261).

Takeshi Yamane discloses a turbocharged internal combustion engine (1) including:

a variable volume combustion chamber (2);

inlet valve means (20, 21) controlling flow of air into the combustion chamber (2);

a fuel delivery means (Not Shown, Well-known compo0enets of the internal combustion engines) for delivering fuel into air to be mixed therewith for combustion, exhaust valve means for controlling flow of combusted gases from the combustion chamber (2); and

compressor means (5B, 6B) for compressing the air prior to admission of the air into the combustion chamber (2),

actuator means (Not Shown, Well-known components of the internal combustion engines) for opening and closing the exhaust valve means (22, 23), and

a controller (Not Shown, Well-known components of the internal combustion engines) configured to control operation of the actuator means to thereby control

opening and closing of the exhaust valve means (22, 23), wherein the improvement in the turbocharged internal combustion engine comprises:

the exhaust valve means (22, 23) including at least a first exhaust valve (22) connected to a first exhaust duct (24) and at least a second exhaust valve (23) connected to a second exhaust duct (25) separate and independent from the first exhaust duct (24);

the compressor means (5B, 6B) including a first turbocharger (5A) and the first exhaust duct (24) being connected to the first turbocharger (5A) so that exhaust gases passing through the first exhaust duct drive the first turbocharger (5, 5A) to rotate;

the second exhaust duct (25) bypassing the first turbocharger (5, 5A) and the combusted gases flowing through the second exhaust duct (25) being exhausted without passing through the first turbocharger (5, 5A); and

the first and second exhaust valves (22, 23) being operable to control flow of the combusted gases leaving the combustion chamber flow through each of the first and second exhaust ducts (24, 25);

the compressor means (5B, 6B) additionally including a second turbocharger (6, 6A, 6B) receiving charge air for compression by the second turbocharger (6, 6A, 6B) and supplying compressed air at a first pressure;

wherein the first turbocharger (5, 5B, 5A) is a high pressure turbocharger and the first turbocharger (5, 5B, 5A) being configured to receive a proportion of the compressed air at a the first pressure from the second turbocharger (6, 6A,

6B), the second turbocharger (6, 6A, 6B) being a low pressure turbocharger, and the first turbocharger (5, 5B, 5A) being configured to compress the compressed air from the second turbocharger (6, 6A, 6B) to a second higher pressure;

the compressor means (5B, 6B) additionally including a bypass passage (8) having a bypass valve (9g, 9H), configured to receive a proportion of the compressed air at the first pressure from the second turbocharger (6, 6B, 6A), and supply the same to the combustion chamber without passing through the first turbocharger (5, 5B, 5A) (See Figure 7, Page 3, lines 16-20 of the fully certified English translation copy);

combusted gases leaving the first turbocharger (5, 5B, 5A) after expansion in a turbine (5A) thereof being combined with the combusted gases flowing in the second exhaust duct (25) and then the combined flow of combusted gases driving the second turbocharger (6, 6B, 6A) to rotate;

all exhaust gases passing through the first exhaust duct (24) flowing through the first turbocharger (5, 5B, 5A) prior to flowing through the second turbocharger (6, 6B, 6A) (See Page 6, lines 1-8 and 12-19 of the fully certified English translation copy).

Takeshi Yamane discloses the invention as recited above; however, Takeshi Yamane fails to disclose an electronic controller, and timing of operation of the actuator means; a bypass valve controlled by the electronic controller; the timing of opening and closing of the first exhaust valve and the second exhaust valve controlling the proportion of the flow of exhaust gas which flows through the first exhaust duct to the first

turbocharger relative to the second exhaust duct being varied by variation of opening and closing of the first exhaust valve.

Pischinger teaches that it is conventional in the supercharged internal combustion engine art, to utilize the electronic controller (6) (See Figure), timing of operation of the actuator means (5.1; 5.2) being controlled by the electronic controller (6) to control timing of opening and closing first and second exhaust valves (3.1; 3.2); and the timing of opening and closing of the first exhaust valve (3.1) and the timing opening and closing of the second exhaust valve (3.2) controlling the proportion of the flow of exhaust gas which flows through the first exhaust duct (7.1) to the first turbocharger (8, 9) relative to the second exhaust duct (7.2) being varied by variation of opening and closing of the first exhaust valve (3.1) (See Figure, Page 6, lines 11-23, Page 7, lines 1-21 of the fully certified English translation copy).

Additionally, Baker teaches that it is conventional in the supercharged internal combustion engine art, to utilize a bypass valve (56) controlled by the electronic controller (54); and the bypass valve (56) controlling the proportion of the compressed air from the second turbocharger (34) received by the bypass passage (26) relative to the first turbocharger (30), the proportion being varied with changes in engine speed (See Figure 3, Column 2, lines 32-40, and Column 6, lines 1-25).

It would has been obvious to one having ordinary skill in the art at that time the invention was made, to have utilized the electronic controller, timing of operation of the actuator means; the timing of opening and closing of the first exhaust valve and the second exhaust valve controlling the proportion of the flow of exhaust gas which flows

through the first exhaust duct to the first turbocharger relative to the second exhaust duct being varied by variation of opening and closing of the first exhaust valve, as taught by Pischinger, and the bypass valve controlled by electronic controller, as taught by Baker, to optimize the exhaust gas to rise to the maximum supercharging pressure of the high pressure turbocharger with almost no time lag and to reduce exhaust emissions for the Takeshi Yamane device.

Response to Arguments

Applicant's arguments filed on March 04, 2010 with respect to claims 1-4, 8, 15-16, 26, and 29-31 have been considered but are moot in view of the new ground(s) of rejection

In response to applicant's arguments on pages 11-14, applicant states that there is no evidence or suggestion in the combination of Yamane and Santo of electronic control timing of opening and closing of first and second exhaust valves which has been amended in the amendment filed on 03/04/2010 in the independent claims 1 and 31.

The new ground of rejection set forth above to address the amended limitation of electronic control timing of opening and closing of first and second exhaust valves.

With regarding to the rejections of claims 4, 26, and 29, applicant asserts that claims 4, 26, and 29 depend upon claim 1, as being discussed above; therefore, Claims 4, 26, and 29 will stand or fall with the corresponding independent claim 1.

With regarding to the rejections of claim 16 and claim 30, applicant asserts that claim 16 and claim 30 depend upon claim 1, as being discussed above; therefore, will stand or fall with the corresponding independent claim 1.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THAI BA TRIEU whose telephone number is (571)272-4867. The examiner can normally be reached on Monday - Thursday (6:30-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas E. Denion can be reached on (571) 272-4859. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TTB
April 6, 2010

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